



Water Quality in Missouri's Larger Rivers

Water Protection Program fact sheet

4/2004

The Upper Mississippi, Missouri, Spring, Elk, Meramec and Gasconade Rivers

Why is long-term monitoring of larger rivers important?

Because of their size, the water quality in Missouri's larger rivers tends to be influenced only by extensive, wide-scale sources such as row-crop agriculture, mining, major channelization or large urban areas. Long-term monitoring of larger rivers allows the most accurate assessment of activities having water quality impacts over a wide scale of both space and time. Long-term monitoring has led us to believe that soil erosion control programs have improved water clarity in some major rivers, while animal production and active and past mining are causing minor water quality declines in others.

How do geology and land use affect water quality and quantity?

Differences in geology and land use result in differences in hydrology and water quality. Missouri has great variety in its geology and land use. The 40 percent of Missouri north of the Missouri River is glaciated prairie, while an additional 10-county area south of the Missouri River in the western part of the state is an unglaciated prairie. These areas are predominately agricultural land used for row crops and pasture. The Ozark plateau, which comprises most of the state south of the Missouri River, is unglaciated hill country with thin soils over old, highly weathered bedrock. It is used mostly as forest or pasture. In prairie watersheds, most rainfall quickly runs off the land surface causing short periods of high stream flows that punctuate long periods with very little flow in streams. In contrast, much more rainfall infiltrates to groundwaters within the Ozark plateau, moderating high flows and providing more flow to streams in the periods between rains through springs and seeps.

Prairie streams, such as the Nodaway, Grand, Thompson and Fabius rivers, contain greater concentrations of almost all water quality constituents. Higher levels of total suspended solids, total phosphorus, total recoverable metals, fecal coliform and fecal strep bacteria in prairie streams are related to the high proportion of surface runoff. Higher levels of sulfate, chloride and total dissolved solids are related to greater leachability of glacial till compared to the old, highly weathered soils and rock in the Ozarks.

Does the water in Missouri's largest rivers meet water quality standards?

The State of Missouri sets standards for water quality in Missouri streams and lakes to protect important water uses such as drinking water supply, protection of aquatic life, swimming and human consumption of fish. In general, water in Missouri's larger rivers meet these state standards.



Are there any exceptions?

The secondary (aesthetic) drinking water standard for dissolved manganese, 50 micrograms per liter, is routinely exceeded in northern Missouri rivers. Several of these rivers, including the Grand, Thompson and Salt, and some of their tributaries are routinely used either as a primary or an auxiliary drinking water supply source by municipalities. Elevated levels of manganese in drinking water can cause taste, odor or laundry staining problems. Some water suppliers in northern Missouri treat drinking water for manganese removal; others do not.

The secondary (aesthetic) drinking water standard for total dissolved solids, 500 milligrams per liter, is occasionally exceeded on the Missouri River, which serves as a drinking water supply for nearly 2 million Missourians. This problem is more frequent (26 percent of all samples) at St. Joseph and much less so in the St. Louis area (four percent). Elevated total dissolved solids in drinking water can cause taste problems and, if sulfates are a major component, can have a mild laxative effect.

What is dissolved oxygen and why is it important?

Dissolved oxygen is the amount of oxygen in the water. Fish and most other forms of aquatic life require oxygen, just like we do, for breathing. Average dissolved oxygen levels have much less biological significance than minimum dissolved oxygen levels. While many small streams are influenced by wastewater discharges and have dissolved oxygen minima during summer low-flow periods, Missouri's larger streams show the greatest dissolved oxygen depression during runoff events. This indicates that nonpoint pollution sources are more important. The Missouri River appears to be the most affected.

A daily dissolved oxygen cycle occurs in most streams as a result of photosynthesis by algae and other aquatic plants. Daily dissolved oxygen usually is lowest near dawn then rises as more sunlight falls on the stream powering the uptake of carbon dioxide and the release of oxygen by aquatic plants. The rate of dissolved oxygen increase between dawn and early afternoon is an indication of the activity of aquatic plants in a particular stream.

What's the difference between point and nonpoint source pollution?

When pollution can be traced back to a single starting point, or source, it is point source pollution. When the pollution cannot be traced back to a single starting point, or it is coming from a multiple of sources, it is called nonpoint source pollution.

What are heavy metals and why are they important?

Heavy metals are natural earth materials that can be toxic if present in sufficient quantities. Small amounts of most heavy metals are present in all waters due to the weathering of soil and rock. Waters affected by industrial waste discharges or certain types of mine drainage can contain higher amounts of heavy metals that may be toxic to fish and wildlife or that cause human health concerns if the water is used as a drinking water source. Aside from the potential aesthetic problems with manganese and total dissolved solids levels discussed above, none of the long-term monitoring suggests any problems with heavy metals in Missouri's larger rivers.

What's been happening in Missouri's rivers over time?

Seven conventional water quality constituents were evaluated for long-term time trends at 15 Missouri stream locations. Total recoverable and dissolved fractions of iron, manganese and

four trace metals (cadmium, copper, lead and zinc) were similarly evaluated at eight stream locations.

Observations on the Mississippi River

The highest levels of inorganic nitrogen (nitrite, nitrate and ammonia) occur on the Mississippi River. Much of this nitrogen comes from the major tributaries such as the Des Moines, Skunk, Iowa and the Cedar rivers, which drain heavily fertilized farm land in Iowa. The increase in nitrogen concentration during runoff events on the Mississippi is much less than for all other rivers in Missouri, suggesting that either there is a very large point source contribution of nitrogen to the Mississippi or that large amounts of nitrogen enter rivers through groundwater in agricultural areas even during times when no runoff is occurring.

- **Can I drink the water from the Upper Mississippi River?**

No. The Missouri Department of Natural Resources recommends that you do not drink untreated water from any surface water. This is because all surface waters contain bacteria and many other waterborne disease organisms. Surface drinking water supplies are generally treated, including disinfection, with chlorine, before the water is distributed for people to safely drink. This treatment process protects humans against bacteria and other chemical contaminants that might enter a river, lake, reservoir, stream or creek.

- **Can I swim in the Upper Mississippi River?**

Yes. The Mississippi River above the confluence with the Missouri River is recognized and protected as a recreational water by the state. All wastewater discharges to this part of river must be disinfected. Monitoring has shown that bacteria levels in this portion of the river meet state water quality standards for whole body contact recreation. Swimmers do need to be mindful of currents.

- **Can I fish in the Upper Mississippi River?**

Yes. In the portion of the Mississippi River adjoining the state of Missouri, mercury levels in fish are typically less than 0.2 parts per million. The maximum recommended level in food is 1 part per million. The Missouri Department of Health has advised that no one consume sturgeon caught in the Mississippi River due to chlordane and PCBs found in them. The Department of Health also advises the public to limit consumption of carp, catfish, suckers and buffalo to one pound per week.

- **Can I use the Upper Mississippi River as a source of drinking water for my livestock?**

Yes.

Observations on the Missouri River

There have been several water quality concerns expressed over the use of Missouri River water in the past 200 years. The river obtained its nickname, the Big Muddy, from the amount of sediment in the water. A more serious problem before adequate water treatment was waterborne diseases such as typhoid. Today, the water quality of the Missouri River is now much improved. Garbage dumping has been eliminated, and all wastewater must be treated before discharge.

- **Can I drink the water from the Missouri River?**

No. The Missouri Department of Natural Resources recommends that you do not drink untreated water from any surface water. This is because all surface waters contain bacteria and many other waterborne disease organisms. Surface drinking water supplies are generally treated, including disinfection, with chlorine, before the water is distributed for people to safely drink. This treatment process protects humans against bacteria and other chemical contaminants that might enter a river, lake, reservoir, stream or creek. A popular agricultural herbicide, atrazine, is detected frequently in the Missouri River, although not at levels that pose a significant health threat. Most of Missouri's drinking water facilities provide treatment most of the time for herbicide removal and taste and odor control.

- **Can I swim in the Missouri River?**

No. The Missouri Department of Natural Resources does not recommend swimming in the Missouri River. Because of the strong current, the state does not recognize swimming as a protected use of the Missouri River, and wastewater discharges to the river are not required to disinfect. The river has higher bacterial counts than most other surface waters in Missouri, and these higher levels present an increased health risk to those who do swim in the Missouri River.

- **Can I fish in the Missouri River?**

Yes. Although the pesticides DDT, dieldrin and chlordane have been banned from use in the United States, some of their residues are still found in Missouri River fish. While most residues are not in quantities considered harmful, the Missouri Department of Health has advised that no one consume sturgeon caught in the Missouri River due to chlordane and PCBs found in them. The Department of Health has also advised the public to limit consumption of carp, catfish, suckers and buffalo to one pound per week.

- **Can I use the Missouri River as a source of drinking water for my livestock?**

Yes.

Observations on southwestern Missouri streams (Spring and Elk rivers)

For most Ozark streams, the water quality is excellent. But on some streams, we have detected water quality changes. Two southwestern Missouri streams, the Spring and Elk rivers, have levels of nitrogen higher than usual for Ozark streams. In addition to high levels of nitrogen, the Spring River has exceptionally high levels of phosphorus. Because the phosphorus decreases as the flow from rainfall increases, the major source of phosphorus may be either a point source or a very localized seepage from nonpoint sources that shows up even during low-flow conditions. The nitrogen is a byproduct of animal waste; the origin of the phosphorus is unknown. Elevated levels of these materials leads to an increase in algae growth, which is a problem for the animals in the rivers. Nitrogen and phosphorous alter the animals' physical habitat, which makes their existence more difficult.

- **Can I drink the water from the Spring and Elk rivers?**

No. The Missouri Department of Natural Resources recommends that you do not drink untreated water from any surface water. This is because all surface waters contain bacteria and many other waterborne disease organisms. Surface drinking water supplies are generally treated, including disinfection, with chlorine, before the water is distributed for people to safely drink. This treatment process protects humans against bacteria

and other chemical contaminants that might enter a river, lake, reservoir, stream or creek.

- **Can I swim in the Spring and Elk rivers?**

Yes.

- **Can I fish in the Spring and Elk rivers?**

Yes.

- **Can I use the Spring and Elk rivers as a source of drinking water for my live stock?**

Yes.

Observations on the Meramec River

The Meramec River at Paulina Hills is the only long-term monitoring location significantly influenced by an urban area. Compared to other Ozark streams, it has elevated levels of ammonia, nitrogen and phosphorus, and the response of phosphorus to flow suggests point sources in the St. Louis area are significant. Elevated levels of these materials leads to an increase in algae growth, which is a problem for the animals in the rivers. Ammonia, nitrogen and phosphorous alter the animals' physical habitat, which makes their existence more difficult.

- **Can I drink the water from the Meramec River?**

No. The Missouri Department of Natural Resources recommends that you do not drink untreated water from any surface water. This is because all surface waters contain bacteria and many other waterborne disease organisms. Surface drinking water supplies are generally treated, including disinfection, with chlorine, before the water is distributed for people to safely drink. This treatment process protects humans against bacteria and other chemical contaminants that might enter a river, lake, reservoir, stream or creek.

- **Can I swim in the Meramec River?**

Yes.

- **Can I fish in the Meramec River?**

Yes. The Missouri Department of Health advises the public to limit consumption of carp, catfish, suckers and buffalo to one pound per week.

- **Can I use the Meramec River as a source of drinking water for my livestock?**

Yes.

Observations on the Gasconade River

The Gasconade River has much higher total suspended solid levels than other Ozark streams, particularly during lower flow conditions. While the origin of the total suspended solids is unknown, the sediment deposits degrade the aquatic habitat, which makes existence for the animals in the water more difficult.

- **Can I drink the water from the Gasconade River?**

No. The Missouri Department of Natural Resources recommends that you do not drink untreated water from any surface water. This is because all surface waters contain

bacteria and many other waterborne disease organisms. Surface drinking water supplies are generally treated, including disinfection, with chlorine, before the water is distributed for people to safely drink. This treatment process protects humans against bacteria and other chemical contaminants that might enter a river, lake, reservoir, stream or creek.

- **Can I swim in the Gasconade River?**

Yes.

- **Can I fish in the Gasconade River?**

Yes.

- **Can I use the Gasconade River as a source of drinking water for my livestock?**

Yes.

Are there any water quality trends on Missouri's rivers?

<u>Stream</u>	<u>Location</u>	<u>Variable*</u>	<u>Trend</u>	<u>Probable Cause</u>
Spring R.	Waco	TDS	Increase	Coal mining, Barton County
		NO ₃	Increase	Unknown
Meramec R. Elk R.	Sullivan Tiff City	SO ₄	Increase	Lead mining, Iron County
		SO ₄	Increase	Unknown
Missouri R.	St. Joseph	NO ₃	Increase	Poultry, hog production
		NO ₃	Increase	Unknown
		TSS	Decrease	Soil conservation
Mississippi R.	Thebes	NO ₃	Increase	Many urban, rural sources
		TSS	Decrease	Unknown
Mississippi R.	Alton	TSS	Decrease	Soil conservation

*Key - **NO₃** - nitrate nitrogen, **SO₄** - sulfate, **TDS** - total dissolved solids, **TSS** - total suspended solids

No long-term monitoring trends were detected on these rivers: Missouri at Hermann, Grand, Nodaway, Thompson, South Fabius, Cuivre, Gasconade, Current and Black.

What could have caused these trends?

The two largest rivers in the state, the Missouri and the Mississippi, both show declining levels of suspended solids. The National Resource Inventory data shows declining soil erosion between 1982 and 1992 for Missouri (28 percent reduction) and nationally (25 percent reduction). The apparent total suspended solids trend on these large rivers may be a result of this reduction in soil erosion.

The Missouri, the Mississippi, the Elk and the Spring rivers all had increasing levels of nitrate nitrogen. Increased confined livestock production and concomitant increases in animal manures applied to fields are probably the major reasons for nitrate increases in southwestern Missouri streams. Reasons for increases in nitrate on the Missouri and Mississippi are probably due to a large number of point and nonpoint sources. Nonpoint runoff of agricultural fertilizers is probably not the major cause for this trend because statistics indicate nitrogen fertilizer use in the Midwest peaked in the 1980s and has declined slightly since then.

Increasing sulfate on the Meramec River and total dissolved solids on the Spring River appear to be due to mining. Reasons for increasing levels of sulfate in the Elk River are not known.

Where can I get more information?

For more information on water quality in Missouri call or write
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P.O. Box 176
Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-1300 office
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